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THE TICK AS A POSSIBLE AGENT IN THE COLLOCATION OF THE EGGS OF *DERMATOBIA HOMINIS* *

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Sufficient observations, consisting of more or less convincing facts and an abundance of circumstantial evidence relating to the egg disposal of *Dermatobia hominis,* have been reported by different writers to prove definitely that a certain species of mosquito, *Psorophora lutzii,* is the active agent in this disposal. However, neither these facts or other evidence that have been submitted up to date are concrete enough to prove that this mosquito is the sole carrier.

In view of this doubt which still reasonably exists in regard to other insects also acting as vectors, one case of infestation with the larvae of this fly was recently brought to the attention of the writer that is considered sufficiently interesting to be worthy of report.

In February of the present year, two members of the staff of this laboratory, Dr. H. C. Clark, pathologist, and Mr. J. E. Jacob, chemist, accompanied by Mrs. Clark, left for a few weeks hunting trip near the headwaters of the Boqueron River in the interior of Panama. Aside from hunting it was also intended to make more or less of a survey of the diseases common among both the human and animal inhabitants of that region. Specimens of insects were also to be collected, especially of the groups known to be concerned in the transmission of the various insect borne diseases of man and animals.

As this was in the dry season of the year the ticks were very numerous and proved to be exceedingly troublesome pests. After being in this region about nine days, Dr. Clark, upon returning to camp after a day's hunt, on February 16, found an adult tick firmly attached to the back of his left hand. It was an unengorged female and had attached itself near the wrist joint on the median line of the hand. The locaton was at the point where a shirt or coat sleeve usually touches the hand. After the removal of the tick the site of attachment was painted with tincture of iodin followed by alcohol.

Two days later upon returning to camp, Dr. Clark found that he was again acting as a host for ticks, and that this time there were three. All three were firmly attached on portions of the body that were well protected with clothing. Two were located on the upper left side of the abdomen at a point above the belt line. They were attached about two inches apart. The third tick was attached on the left side of the back, also above the belt line. All three were removed and the site of each attachment well swabbed with iodin.

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The four sites from which these three ticks, and the one previously found on the back of the hand, had been removed behaved like tick bites in which the proboscis had been left in the skin and delayed the healing. The tiny wounds refused to heal, although all four were treated twice a day with iodin followed by alcohol. The iodin was even introduced well down into the wound on the sharpened end of a match. Each of the four small wounds remained unchanged and continued to ooze small quantities of serum at intervals without any healing results being obtained from the iodin treatment, until February 27. On this date while returning to the Canal Zone, Dr. Clark noticed the lesion on the left hand beginning to swell like a small boil, and it soon became rather painful. This may have been hastened by using the hand rather freely in paddling a canoe. It had been suspected for several days that the presence of a larva in the wound was the cause of the non-healing. An examination was now made with the aid of a hand lens which verified the suspicion and an incision produced a Dermatobia larva 4 mm. in length.

Although it was now quite certain that the three lesions on the body also contained larvae, no further attention was given them except to continue the iodin treatment daily. They remained unchanged until March 6, when an area of from one-half to one and one-half inches around each wound began to swell and become red and painful. Frequent pricking and boring sensations were felt in the wounds, which at times were equivalent to the pricking of a hypodermic needle. A serous exudation was also occasionally noticed. This continued until March 8, when quite a severe glandular swelling began to take place on the left side, and it was then considered advisable to remove the larvae. Incisions were now made and a small Dermatobia larva removed from each wound. The smallest one was 2.5 mm. in length, and the largest one approximately 4 mm.

In order to make a positive identification of the larvae, when the first one was removed from the back of the hand it was placed in a small incision made in the skin on the back of the neck of a guinea-pig. This was done within an hour after its removal. It immediately began burrowing downward at one side of the incision. In three hours it was entirely buried under the skin, with the exception of the small posterior end, which was still visible. The following day the larva was out of sight and the incision healed over except for a small raised area in the center. In this area a minute round crater-like opening remained. The serous fluid evacuated by the larva was being ejected through this opening. This small raised area slowly increased day by day into a swelling about three-fourths of an inch long, and over one-half inch in diameter and emitted an offensive odor. On April 7, thirty-eight days later, the guinea-pig died. Within five hours after the death of the pig the larva emerged through the small opening. It was 20 mm. in length and 6 mm. in diameter, and we were able to identify it as *D. hominis*. The larva died before pupating.

A few months later Dr. Clark became infested a second time while hunting near Arraijan, on the west side of the Canal. This infestation was also preceded by a tick attachment. On the evening of May 13, after returning from a day's hunt, a small tick evidently a nymph, was found attached on the right side of the abdomen. It was about midway between the groin and the umbilicus, and well beneath the belt line. After the removal of the tick the point of attachment was given the customary treatment of iodin and alcohol for several days without getting healing results. On May 23, a slight pricking sensation was felt in the small lesion. This pricking sensation gradually increased and the small serum-oozing crater could be plainly viewed; the larva inside was easily discernible by the use of a hand lens. The larva was allowed to remain in situ until June 4. An incision was then made and a Dermatobia larva, 2 mm. in length, was removed. This made five larvae of Dermatobia in which a tick had preceded the larva in each instance. Each larva was found in the site of a tick bite, and four of these locations were well protected by clothing.

In order that due weight may be given to the observations it must be remarked that Dr. Clark is a very close observer. He is well versed in medical entomology and is also familiar with the larvae of Dermatobia and the existing theories regarding the manner of disposal of the eggs.

While on the trip mosquito bars were always used while sleeping and due caution exercised while bathing, and the body protected with clothing at all times when possible. In view of these facts it would hardly have been possible for mosquitoes to reach the parts of the body where four of the larvae were situated. However, as has been shown, ticks may easily gain access to the inside of the clothing and attach themselves to almost any part of the body before being discovered.

In these cases the daily application of iodin had no appreciable effect on the young larvae. It did assist, however, in definitely marking the site of each bite, and in proving that each larva was located in a lesion primarily caused by a tick.

In the low lying territory adjacent to Gatun Lake between Gamboa and the quick waters of the Chagras ticks and mosquitoes were found equally numerous. Here the inhabitants were few and no cases of infestation with larvae of Dermatobia were noted among either man or animals. The river regions in the vicinity of the lower reaches of the Chagras and Pequeni rivers, between Alhajuela and Boca Culebra, were well populated and several cases of Dermatobia infestations were observed in domestic animals. Among the animals found to be infested, the dogs and calves seemed to be the most prolific hosts. It is needless to state that both of these animals also act as hosts for numbers of ticks. In this locality both ticks and mosquitoes were present in large numbers. As the party advanced along the Pequeni and Boqueron rivers to the higher regions the inhabitants became fewer in number. At the headwaters of the Boqueron the final camp was made, and some of the surrounding country hunted over and inspected. No inhabitants or domestic animals were found in this vicinity, but the ticks were encountered in greater abundance than in the lower regions, and were found in numbers swarming over the grass and bushes, evidently living on the wild animals such as deer, peccary, tapir, jaguar, puma, ocelot, anteater, capybara, agouti, monkey and many smaller animals with which the region abounded. In this area the higher elevation affording better drainage, the coolness of the nights, due to the high altitude, evidently proved unfavorable for mosquito breeding, as none were found at this place. No signs of Dermatobia larvae were observed in any of the wild animals killed in this locality, but it was at this point that Dr. Clark became infested. Lastly it is worthy of mention that of the many specimens of mosquitoes collected by the party and brought back for identification, not a single specimen of *P. lutzii* was present.

It is to be regretted that none of the five ticks that are suspected of carrying the eggs were preserved. But as these individuals were only a small part of the number that attached themselves to the different members of the party while on this trip, it is not strange that they were not preserved, as no particular attention was paid to these specimens until the lesions caused apparently by their bites failed to heal. However, other specimens found attached to different members of the party, as well as some of those that were found to be so numerous on the grass, bushes, fallen trees, etc., were brought back to the laboratory and all proved to be specimens of the Cayenne tick, *Amblyomma cajennense.* This tick has a variety of hosts, and attacks man and all classes of both domestic and wild animals with equal freedom.

In the face of this evidence it is but reasonable to consider that a species of tick, probably *A. cajennense,* not only acted as the carrier of the eggs, but was also instrumental in assisting the larvae to penetrate the skin.

The incrimination of the tick opens up a new theory on this subject and we hope it will stimulate investigations along a new line on the habits of this insect.